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(21)Application number : 05-066735 (71)Applicant : OLYMPUS OPTICAL CO LTD

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(54) IMAGE OBSERVATION DEVICE

(57)Abstract:
PURPOSE: To reduce the reflection of external light, entering the image observation device having at least one optical system between a liquid crystal display device, etc., and the eye of an observer, and make an image easy to see by arranging a polarizing

element between the optical system and eye.

CONSTITUTION: In the image observation device like an electronic finder which enables an image formed by the liquid crystal display device LCD, etc., to be observed through a lens 5 as the optical system, a polarizing filter 6 which has the axis of polarization set to the same direction with the eye-side polarizing plate 4 of a liquid crystal panel 3 constituting the LCD is arranged between the lens 5 and eye. The external light is transmitted through the polarizing filter 6 twice when made incident on the electronic finder from the eye side and exiting to the outside after being reflected inside. The light emitted from the LCD, on the other hand, is already polarized, so the intensity after the light is transmitted through the polarizing filter 6 is affected only by the parallel transmissivity. The ratio of the external light of the LCD made incident on the eye to the reflected light of the external light can be improved by as much as the reflected light of the external light is reduced.

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CLAIMS

[Claim(s)]

[Claim 1] Image observation equipment characterized by having arranged the polarizing element between said optical system and eyes in the image observation equipment which arranges at least one optical system and changes between the display which constitutes an image by polarization, and an observer's eye.

[Claim 2] the polarizing element of two sheets -- containing -- **** -- this -- the image observation equipment which arranges the liquid crystal cell and optical system which form an image, and changes between the polarizing elements of two sheets.

[Claim 3] the polarizing element of three sheets -- containing -- **** -- this -- the image observation equipment arranged between the liquid crystal cells and optical system in which one in the polarizing element of three sheets forms an image.

[Claim 4] It is image observation equipment according to claim 3 with which said the first sheet and handsome polarizing element is arranged from the eye side so that the polarization direction may become a real Kamitaira line.

[Claim 5] Said optical system is image observation equipment given in claim 1 thru/or any of 4 they are. [which consists of the single glass lens]

[Claim 6] the polarizing element of two sheets -- this -- the image observation equipment which includes the liquid crystal cell and optical system which form the image arranged between the polarizing elements of two sheets, arranges the wavelength plate which produces lambda(2n+1)/4 (however, wavelength of n= 0, 1, 2 and 3, ..., lambda= light) of phase contrast, respectively, and changes between said polarizing elements and said liquid crystal cells.

[Claim 7] Said wavelength plate of two sheets is image observation equipment according to claim 6 which shaft orientations were parallel or lay at right angles, and has been arranged so that the include angle of 45 degrees may be made to said polarizing plate.

[Claim 8] Image observation equipment which consists of the polarizing element arranged so that the include angle theta to which the normal stood to the front face is satisfied with an eye side of the following conditions to an optical axis from a back light, a polarizing plate, the display equipped with the liquid crystal cell, and this display may be made and it may incline in order to form an image by polarization, and an ocular.

(theta1+theta2) / 2< theta<85 degrees, however theta 1 The incident angle of the beam of light which carries out incidence from an eye point to the edge of a screen in a flat surface including the above-mentioned normal and optical axis of the polarizing plate by which **** arrangement was carried out, and theta 2 The intersection of said beam of light and polarizing plate which carry out incidence to the edge of a screen

When the side which has Intersection P on both sides of the optical axis in the point that only distance l left the distance between H and Intersections P and H from Intersection H, from hp and Intersection H in the intersection of the perpendicular and optical axis which were given from P and Intersection P to the optical axis sets the height to a reverse near equipment frame to hl in the range to an eye point, It is the minimum value of the value expressed with tan-1 (hp+hl) / l.

[Claim 9] Image observation equipment which has arranged this liquid crystal display so that it consists of a back light, a liquid crystal display, and an ocular in order to form an image by polarization, and the normal stood to the front face of this liquid crystal display may make the include angle theta with which are satisfied of the following conditions and may incline to an optical axis.

(theta1+theta2) -- /2<theta, however theta 1 The incident angle of the above-mentioned normal of the liquid crystal display by which skew arrangement was carried out, and the normal which carries out incidence from an eye point to the edge of a screen in a flat surface including an optical axis, and theta 2 When the side which has Point R on both sides of the optical axis in the point that only distance m left the distance between H', H', and R from intersection H', from hr and intersection H' in the intersection of the perpendicular and optical axis which gave the point of the edge of a screen from R and R to the optical axis sets the height to a reverse near equipment frame to hm in the range to an eye point, It is the minimum value of the value expressed with tan-1 (hr+hm) / m.

DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Industrial Application] This invention relates to the image observation equipment like the finder for camcorders, or a still video finder which enabled it to observe the image formed by the liquid crystal display etc. through optical system.

[0002]

[Description of the Prior Art] In this kind of image observation equipment, if light goes into the interior of equipment from the exterior, an image will benefit that reflected light hard to see. Therefore, conventionally, a part for a hood was improved, and

outdoor daylight was made not to carry out incidence inside equipment, or the antireflection film etc. was given to the reflector inside equipment, and measures, such as reducing a reflection factor, were taken.

[Problem(s) to be Solved by the Invention]

[0003] In the camera of the electronic image field, the finder of the method which expands and looks at screens, such as CRT and LCD, by optical system from the former has been used. However, even if it takes a cure, such as reducing the above reflection factors in dark LCD of a screen compared with CRT, in addition, reflection of the outdoor daylight by the finder lens side or the LCD front face cannot be disregarded, but it has been a problem.

[0004] Moreover, although a gobo must be enlarged more in order to prevent penetration of the outdoor daylight into a finder efficiently, in the case of the method using the **** gobo and hood which were proposed in JP,1-146227,U, the part of this which touches an observer's skin directly at the time of about [making handling and carrying of finder equipment inconvenient] and observation increases, and there is a trouble it is told to an observer that gives displeasure in it. Moreover, when an antireflection film is used, there is also a problem referred to as becoming a cost rise.

[0005] The place which this invention is made in view of such a trouble that a Prior art has, and is made into the purpose is to offer the image observation equipment which can be made to be able to reduce more reflection of the outdoor daylight which advanced into the interior, and can raise the vanity of an image.

[Means for Solving the Problem]

[0006] In order to attain the above-mentioned purpose, the image observation equipment by this invention is equipped with the polarizing element arranged between at least one optical system arranged between the image display device like a liquid crystal cell, and an image display device and an observer's eye, and this optical system and an eye.

[0007] Two polarizing elements may be used by arrangement which sandwiches a liquid crystal cell and optical system, and may be used three sheets by the arrangement between which the polarizing element of one more sheet was made to be placed between a liquid crystal cell and optical system. In this case, from the eye side, it is arranged so that, as for the first sheet and handsome polarizing element, the polarization direction may become a real Kamitaira line. Moreover, optical system is a single glass lens and the wavelength plate which produces lambda/4 (however, wavelength of n= 0, 1, 2 and 3, ..., lambda= light) of phase contrast (2n+1) may be arranged between the polarizing element and the display. Furthermore, the wavelength plate of two sheets is arranged so that shaft orientations are parallel, or may lie at right angles and the include angle of 45 degrees may be made to a polarizing plate.

[0008] Furthermore, a polarizing element may be arranged so that the include angle theta with which are satisfied of the conditions which /(theta1+theta2)2<theta< 85

degrees of normals stood to the front face become from a display to an optical axis by the eye side may be made and it may incline. theta 1 [however,] The incident angle of the beam of light which carries out incidence from an eye point to the edge of a screen in a flat surface including the above-mentioned normal and optical axis of the polarizing plate by which **** arrangement was carried out, and theta 2 The intersection of said beam of light and polarizing plate which carry out incidence to the edge of a screen When the side which has Intersection P on both sides of the optical axis in the point that only distance l left the distance between H and Intersections P and H from Intersection H, from hp and Intersection H in the intersection of the perpendicular and optical axis which were given from P and Intersection P to the optical axis sets the height to a reverse near equipment frame to hl in the range to an eye point, It considers as the minimum value of the value expressed with tan-1 (hp+hl) / l. Moreover, in this case, a polarizing plate is arranged, as it is in the field where that transparency shaft includes the above-mentioned normal and an optical axis.

[0009] It inclines and an image display device may be arranged so that the conditions which the angle theta of the normal of the front face and an optical axis 2<theta [(theta1+theta2) /] Becomes may be satisfied. theta 1 [however,] The incident angle of the beam of light which carries out incidence from an eye point to the edge of a screen in a flat surface including the above-mentioned normal and optical axis of the display by which **** arrangement was carried out, and theta 2 An intersection with the screen of said beam of light which carries out incidence to the edge of a screen When the side which has Intersection R on both sides of the optical axis in the point that only distance m left the distance between H', and Intersection R and H' from intersection H', from hr and intersection H' in the intersection of the perpendicular and optical axis which were given from R and Intersection R to the optical axis sets the height to a reverse near equipment frame to hm in the range to an eye point, It considers as the minimum value of the value expressed with tan-1 (hr+hm) / m.

[0010]

[Function] In an electronic finder (henceforth EVF) like the finder for camcorders, or a still video finder, reflection of the outdoor daylight used as the cause of the difficulty of being visible is mainly a thing from a lens front face and the front face of a display. According to this invention, since the polarizing element is arranged in EVF at the side near [liquid crystal display / (henceforth LCD)] an eye, outdoor daylight and its reflected light can be attenuated without attenuating the light which forms the image which should be observed, and vanity is raised.

[0011] Namely, as shown in drawing 1 , the polarizing filter 6 with which the polarization shaft was arranged with the polarizing plate 4 and the same direction by the side of the eye of the liquid crystal panel 3 which constitutes LCD between the lens 5 as optical system and an eye is arranged. It is [luminous intensity / which comes out of the luminous intensity by which the outdoor daylight which carried out

incidence from the eye side in the conventional EVF reflects inside EVF, and goes into an eye from R and LCD, and goes into an eye] TP in the permeability of S and a polarizing filter 6 about the parallel permeability (permeability of polarization parallel to a polarization shaft) of T and a polarizing filter 6. If it carries out Since outdoor daylight will penetrate the 2 times polarizing filter 6 when reflecting in the time of the incidence to EVF, and the interior, and injecting to the exterior, the reinforcement N is set to TxTP xR. On the other hand, since the light which came out of LCD is already polarizing, the reinforcement S after penetrating a polarizing filter 6 is set to TP xI. Here, if a S/N ratio is taken, it becomes (TP xI)/(TxTP xR) = (1/T) (I/R), and since it is T< 1, a S/N ratio will improve.

[0012] Moreover, in the above-mentioned configuration, although there are two polarizing elements which arranged the polarization shaft with the same direction on both sides of the lens 5 in the eye side of a liquid crystal panel 3, since there should just be one of sheets of this in order to see an image, the polarizing plate 4 by the side of the eye which constitutes LCD as shown in drawing 2 may be removed. An operation of the removed polarizing plate 4 can be executed by proxy with a polarizing filter 6, and the intensity of light of an image is set to I as well as the case of drawing 1 in this case. If a S/N ratio is taken here, it becomes I/(TxTP xR) =[1/(TxTP)] - (I/R), and since it is TP <1, a S/N ratio will improve more.

[0013] By arranging a polarizing element to the EVF side nearest to an eye as mentioned above, the incident light and the reflected light to EVF can be attenuated, the S/N ratio of an image can be raised, and vanity can be improved.

[0014] moreover, the polarizing plate 2 by which turned LCD to the eye side from the back light 1 side, and the sequential array was carried out as shown in drawing 9 and lambda (2n+1)/4 wavelength plate 12 (n= 0, 3 [1, 2 and 3], and ....) If constituted from the wavelength, the liquid crystal cell 3, lambda (2m+1)/2 wavelength plate 13 (m= 0, 3 [1, 2 and 3], ...), and polarizing plate 4 of lambda= light Since it will pass along a wavelength plate 13 twice and 90 degrees of sense of plane of polarization rotate, the reflected light from the field which is in an eye side from the rear face of the liquid crystal cell 3 which becomes harmful when observing an image among the light which carried out incidence from the eye side and penetrated the polarizing plate 4 is almost absorbed with a polarizing plate 4. Thereby, reflection in the liquid crystal cell 3 interior can also be decreased. On the other hand, although the light by the side of a back light 1 turns into the linearly polarized light and turns into the circular polarization of light by passing a wavelength plate 12 by passing along a polarizing plate 2, since it becomes the linearly polarized light again and incidence is carried out to a polarizing plate 4 by passing a wavelength plate 13, it can obtain an image as usual.

[0015] Moreover, as shown in drawing 10 , when the angle theta of the normal and optical axis which were stood to the front face of a polarizing plate 6 to make fills conditional expression (theta1+theta2) / 2< theta<85, the light which carried out

incidence and which came out of the eye point EP, and was reflected on the front face of a polarizing plate 6 in the finder does not come outside in a frame. Conversely, if it thinks, even if the light which carried out incidence from outside reflects on the front face of a polarizing plate 6, the light will not go into an eye. theta 1 [however,] The incident angle of the beam of light which carries out incidence from an eye point to the edge of a screen in a flat surface including the above-mentioned normal and optical axis of the polarizing plate by which **** arrangement was carried out, and theta 2 The intersection of said beam of light and polarizing plate which carry out incidence to the edge of a screen When the side which has Intersection P on both sides of the optical axis in the point that only distance l left the distance between H and Intersections P and H from Intersection H, from hp and Intersection H in the intersection of the perpendicular and optical axis which were given from P and Intersection P to the optical axis sets the height to a reverse near equipment frame to hl in the range to an eye point, It considers as the minimum value of the value expressed with tan-1 (hp+hl) / l. Furthermore, the reflection factor in a front face takes the value which changes with oscillating directions of light depending on whenever [incident angle]. S component parallel to a reflector increases in monotone as an incident angle increases, and it decreases temporarily as the incident angle of P component contained on the other hand in the field containing the normal and incident ray of a reflector increases, and when an incident angle becomes equal to tan-1n (n is the refractive index of a polarizing plate 6), it is set to 0. Although it increases in monotone after that, an incident angle serves as an S component >=P component in 0 to 90 degrees. Moreover, the transmission of P component of the leaned polarizing plate 6 is theta=tan by arranging the transparency shaft of a polarizing plate 6 in the direction used as P component. It becomes max near -1n, and sufficient transmission can be obtained even if it does not perform coating. Since it decreases as theta of permeability of the outdoor daylight which contains S component in coincidence increases, the reflection by the reflector which is in the LCD side from a polarizing plate 6 decreases.

[0016] moreover, the angle of the normal and optical axis which were stood on the surface of the image display device (LCD) as shown in drawing 11 to make -- theta -- carrying out -- theta> (theta1+theta2) / 2 -- when satisfying conditions, the light which came out of the eye point and carried out incidence to the finder and which was reflected a front face and inside the image display device does not come outside in a frame Conversely, if it thinks, even if the light which carried out incidence from outside reflects a front face and inside an image display device, the light will not go into an eye. theta 1 [however,] The incident angle of the beam of light which carries out incidence from an eye point to the edge of a screen in a flat surface including the above-mentioned normal and optical axis of the display by which skew arrangement was carried out, and theta 2 When the side which has Point R on both sides of the

optical axis in the point that only distance m left the distance between H', H', and R from intersection H', from hr and intersection H' in the intersection of the perpendicular and optical axis which gave the point of the edge of a screen from R and R to the optical axis sets the height to a reverse near equipment frame to hm in the range to an eye point, It considers as the minimum value of the value expressed with tan−1 (hr+hm) / m.

[0017]

[Example] Drawing 1 shows the 1st example of this invention. the inside of drawing, and F -- for a polarizing plate and 3, as for a polarizing plate and 5, a liquid crystal cell and 4 are [an equipment frame and 1 / a back light and 2 / a glass lens and 6] polarizing filters. In this case, each plane of polarization of polarizing plates 2 and 4 and a polarizing filter 6 is arranged in the same direction, and what has the following property as a polarizing filter 6 was used. In addition, polarizing plates 2 and 4 and a liquid crystal cell 3 constitute LCD.

Simple substance permeability (T) 43% 81.8% (TP) of parallel permeability 4.2% (TC) of rectangular permeability ** Light Whenever 95% [0018] Incidence of the outdoor daylight is carried out to the interior of the equipment frame F from an eye side, and it penetrates a polarizing filter 6, it reflects inside, and it penetrates a polarizing filter 6 again, and goes into an eye. Therefore, the reflected light will pass along a polarizing filter 6 twice, and the intensity of light decreases to 33.5%. On the other hand, in order that the light from LCD may also go into an eye through a polarizing filter 6, unlike the former (at the time of no coping with it), the intensity of light decreases to 81.8%. Therefore, it turns out that the S/N ratio in the case of this example will be set to 2.44 if the S/N ratio at the time of no coping with it is placed with 1, and a S/N ratio improves remarkably. In addition, the antireflection film was given to the front face of a polarizing filter 6 in order to prevent surface reflection of a polarizing filter 6. Since what is necessary is just to add a polarizing filter to EVF which used the conventional LCD, this example can be carried out very easily and cheaply.

[0019] Drawing 2 shows the 2nd example of this invention. This example differs from the 1st example in that the polarizing plate 4 is removed from LCD. Therefore, supposing the surface reflection factor of a polarizing plate 2 and a liquid crystal cell 3 is the same, the strength of the reflected light by the outdoor daylight included in an eye will decrease to 33.5% like the case of the 1st example. On the other hand, since the light from LCD is considered to be what the polarizing plate by the side of the eye of LCD moved to the before [a lens] side with the configuration at the time of no coping with it the same way, if it thinks that there is no strong change, a S/N ratio will be set to 2.99 and its S/N ratio will improve further rather than the 1st example.

[0020] Since the components mark of about [that only the reflected light by outdoor daylight can be reduced] and the LCD section can also be reduced in the 2nd example, without decreasing the brightness of an image, the effectiveness is size. In

this example, in order to prevent the effect by the birefringence of optical system, it is good to constitute an optic from an ingredient which birefringences, such as glass or an acrylic, cannot produce easily. Moreover, since it is the partially polarized light when carrying out incidence into EVF after outdoor daylight reflects once in an observer's face, the outdoor daylight which goes into an eye much more efficiently can be decreased by arranging a polarizing filter and a polarizing plate in the polarization direction and the direction which intersects perpendicularly.

[0021] Drawing 3 shows the 3rd example of this invention. This example is the point of having made it not go into an eye even if it has leaned and arranged and outdoor daylight reflected on that front face so that the normal which stood the polarizing filter 6 to that front face might make theta** (about about 45 degrees) to an optical axis, and differs from the 2nd example. Thus, since it is absorbed in the wall of the equipment frame F, the light reflected on the surface of the polarizing element among the outdoor daylight which carried out incidence from the eye side by leaning a polarizing element can reduce the effect of an increment of the reflector by it, even when a polarizing element is added. About the field on the backside [polarizing filter / 6] (back light 1 side), there is the same effectiveness as the 2nd example. As shown in drawing 10 , Above theta the incident angle of the beam of light which carries out incidence from an eye point EP to the edge A of the screen of LCD in a flat surface including the normal stood to the front face of the polarizing filter 6 by which **** arrangement was carried out, and an optical axis In addition, theta 1, The intersection of this beam of light and polarizing filter 6 The side which has Intersection P on both sides of the optical axis in the point that only distance l left the distance between H and Intersections P and H from Intersection H, from hp and Intersection H in the intersection of the perpendicular and optical axis which were given from P and this intersection P to the optical axis sets the height to the reverse near equipment frame F to hl in the range to an eye point EP. the minimum value of the value expressed with tan-1 (hp+hl) / l -- theta 2 ** -- the time of carrying out -- (theta1+theta2) / 2< theta<85 degrees -- it is selected so that conditions may be satisfied.

[0022] In EVF, since observation for a high scale factor is enabled more, optical members, such as a diffraction grating, may be used. The example using this is explained below as the 4th, 5, and 6 examples.

[0023] Drawing 4 shows the 4th example of this invention. This example differs from the 1st example in that the dot eraser filter (filter which cuts the frequency component corresponding to the dot space of the image which consists of points (dot)) 7 is joined to the liquid crystal cell 3 instead of the polarizing plate 4 in LCD. Also in this case, like the 2nd example, a polarizing filter 6 is in the side nearest to an eye, and about 1/of effects of reflection of each side of an optical member is set to 3.

[0024] Drawing 5 shows the 5th example of this invention. This example differs from the 4th example in having made it not go into an eye, even if it has leaned and

arranged and outdoor daylight reflected on that front face so that the normal which stood the polarizing filter 6 to that front face might make theta** (about about 45 degrees) to an optical axis. The advantage in this case is the same as that of the case of the 3rd example, and the selection conditions of theta of it are the same as that of the case of the 3rd example.

[0025] Drawing 6 shows the 6th example of this invention. This example is the point which separated the dot racer filter 7 from the liquid crystal cell 3, joined to the polarizing filter 6, and has arranged this between LCD and a lens 5, and differs from the 5th example. In this case, the air contact surface of an optical member can be reduced by junction, and effect of reflective of the eye side front face of a liquid crystal cell 3 can be set to one third.

[0026] Drawing 7 shows the 7th example of this invention. This example is the point of having joined in order and having used a convex-plano lens 8, the polarization film 9, and a plano-convex lens 10 instead of the lens 5 and the polarizing filter 6, and differs from the 2nd example. In this case, the air contact surface can be reduced by being able to set effect of reflection of each side of a lens 8 and a liquid crystal cell 3 to one third, and using junction. In addition, the polarization film 9 is very thin, and the joined lens is fabricated so that it may become the lens 5 and equivalence in said each example.

[0027] Drawing 8 shows the 8th example of this invention. This example is the point that make one field of a lens 11 into a flat surface, and the polarizing filter 6 is joined by that flat surface, and differs from the 7th example. In this case, effect of reflective of a lens and an optical member can be set to one third like the 7th example.

[0028] Furthermore, it explains below by making the example also in consideration of reflection by the electrode inside the liquid crystal cell of LCD etc. into the 9th example. Drawing 9 shows the 9th example of this invention. This example differs from said any example in that the quarter-wave length plates 12 and 13 are made to intervene, respectively between a liquid crystal cell 3 and polarizing plates 2 and 4, and the polarizing filter 6 is not used for it in LCD. In this case, since 90 degrees of planes of vibration rotate, the light which penetrated the polarizing plate 4 and was reflected among the quarter-wave length plates 13 and 12 can hardly penetrate a polarizing plate 4. Therefore, the effect by reflection of the light by the electrode of the liquid crystal cell 3 interior etc. can also be lost mostly. The polarization shaft orientation of a polarizing plate and 45 degrees of shaft orientations of a quarter-wave length plate are shifted. Moreover, as a wavelength plate, although lambda(2n+1)/4 (n= 0, 1, 2 and 3, ...) of wavelength plates can be used, in order to reduce a wavelength property, lambda/4 wavelength plate is desirable.

[0029] Drawing 12 shows the 10th example of this invention. It leans and this example is arranged so that the normal which stood LCD to that front face may make theta** (about 20 degrees) to an optical axis, and it differs from said any example in having

made it not go into an eye, even if outdoor daylight reflected on that front face. It can avoid going the reflected light from a LCD front face and the interior into an eye according to this example, without increasing a member. In this case, in order to lessen effect of the diopter gap by the inclination of the image surface, the smaller one of the value of theta is desirable.

[0030] It will be as follows if the numeric data of the lens used in each example above is shown. Lens 5fB =41.00R1 =32.72 D 1 = 4.8 n= 1.56384 nu=60.69 R2 =-87.40 (aspheric surface)

E=0.115 x10-4 D1 =1.8 n=1.56384 nu=60.69 R2 =-87.40 (aspheric surface) F=-0.2457 x10-7G=-0.7378 x10-10 H=0.3220x10-12 lens 8fB =41.00R1 =32.72 D 1 = 3.0 n= 1.56384 nu=60.69 R2 =infinity lens 10R1 =infinity

E= 0.115x10-4 F=-0.2457 x10-7G=-0.7378 x10-10 H=0.3220x10-12 lens 11fB =43.00R1 =23.956 (aspheric surface) D 1 = 5.0 n= 1.56384 nu=60.69 E=0.1298x10-4 F=-0.1049 x10-8G=0.8035x10-11 R2 =infinity -- however fB The distance (F back) from the plane peak by the side of LCD of a lens to a liquid crystal cell (image surface), R1, and R2 Radius of curvature and D1 Thickness and n are [the Abbe number, and E, F, G and H of a refractive index and nu] aspheric surface multipliers.

[0031] Although one lens was used in each above-mentioned example, it may replace with this and a lens system may be used, and a lens (lens system) may be moved forward and backward, a diopter compensation device may be added, a mirror is further inserted in a finder system, and you may enable it to constitute an optical path for the whole bending equipment in a compact.

[0032]

[Effect of the Invention] Like ****, according to this invention, compared with the image constituted by polarization, the reflected light by the outdoor daylight produced in the backside [polarizing plate] can be decreased sharply, the S/N ratio of an image can be raised, and very legible image observation equipment can be offered cheaply.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] It is the side elevation showing the 1st example of this invention.

[Drawing 2] It is the side elevation showing the 2nd example of this invention.
[Drawing 3] It is the side elevation showing the 3rd example of this invention.
[Drawing 4] It is the side elevation showing the 4th example of this invention.
[Drawing 5] It is the side elevation showing the 5th example of this invention.
[Drawing 6] It is the side elevation showing the 6th example of this invention.
[Drawing 7] It is the side elevation showing the 7th example of this invention.
[Drawing 8] It is the side elevation showing the 8th example of this invention.
[Drawing 9] It is the side elevation showing the 9th example of this invention.
[Drawing 10] It is drawing for explaining the inclination conditions of the polarizing filter in the 3rd example and the 5th example of this invention.
[Drawing 11] It is drawing for explaining the inclination conditions of an image display device.
[Drawing 12] It is the side elevation showing the 10th example of this invention.
[Description of Notations]
1 Back Light
2 Four Polarizing plate
3 Liquid Crystal Cell
5, 8, 10, 11 Lens
6 Polarizing Filter
7 Dot Racer Filter
9 Polarization Film
F Equipment frame

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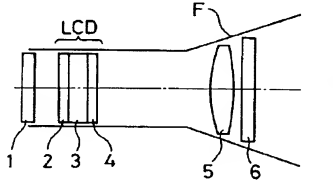
(54)【発明の名称】　画像観察装置

(57)【要約】

【目的】　外光の反射を低減させて画像の見えを良くすることのできる画像観察装置を提供する。

【構成】　装置枠（Ｆ）内に、バックライト（１）と、液晶表示装置（ＬＣＤ）と、レンズ（５，８，１０，１１）と、偏光素子（６，９）が順次配列されている。偏光素子は、眼に最も近い位置に配置されるか、液晶表示装置とレンズの間に光軸に対して垂直又は傾けて配置されるか、レンズと接合した状態で配置されている。



【特許請求の範囲】

【請求項１】　偏光により画像を構成する表示装置と観察者の眼との間に少なくとも一つの光学系を配置して成る画像観察装置において、前記光学系と眼との間に偏光素子を配置したことを特徴とする画像観察装置。

【請求項２】　二枚の偏光素子を含んでいて、該二枚の偏光素子の間に画像を形成する液晶セルと光学系を配置して成る画像観察装置。

【請求項３】　三枚の偏光素子を含んでいて、該三枚の偏光素子の内の一枚は画像を形成する液晶セルと光学系との間に配置されている画像観察装置。

【請求項４】　眼側から一枚目と二枚目の前記偏光素子は、偏光方向が実質上平行になるように配置されている、請求項３に記載の画像観察装置。

【請求項５】　前記光学系は単一のガラスレンズから成っている請求項１乃至４の何れかに記載の画像観察装置。

【請求項６】　二枚の偏光素子と該二枚の偏光素子の間に配置された画像を形成する液晶セルと光学系とを含んでいて、前記偏光素子と前記液晶セルとの間に、（２ｎ＋１）λ／４（但し、ｎ＝０，１，２，３，‥‥，λ＝光の波長）の位相差を生じさせる波長板を夫々配置して成る画像観察装置。

【請求項７】　二枚の前記波長板は、軸方向が平行又は直交していて、前記偏光板に対し４５°の角度をなすように配置された、請求項６に記載の画像観察装置。

【請求項８】　偏光により画像を形成するためバックライトと偏光板と液晶セルを備えた表示装置と、該表示装置よりも眼側で表面に立てた法線が光軸に対して以下の条件を満足する角度θをなして傾斜するように配置された偏光素子と、接眼レンズとから成る画像観察装置。

$(\theta_1 + \theta_2) / 2 < \theta < 85°$

但し、θ_1 は斜向配置された偏光板の上記法線と光軸とを含む平面においてアイポイントより画面の端へ入射する光線の入射角、θ_2 は、画面の端へ入射する前記光線と偏光板との交点をＰ，交点Ｐから光軸へ下した垂線と光軸との交点をＨ，交点ＰとＨとの間の距離をｈｐ，交点Ｈよりアイポイントまでの範囲で交点Ｈより距離ｌだけ離れた点での光軸を挟んで交点Ｐがある側とは反対の側の装置枠までの高さをｈｌとしたとき、$\tan^{-1}(hp + hl) / l$ で表わされる値の最小値である。

【請求項９】　偏光により画像を形成するためバックライトと液晶表示装置と接眼レンズから成り、該液晶表示装置の表面に立てた法線が光軸に対して、以下の条件を満足する角度θをなして傾斜するよう、該液晶表示装置を配置した画像観察装置。

$(\theta_1 + \theta_2) / 2 < \theta$

但し、θ_1 は斜行配置された液晶表示装置の上記法線と光軸を含む平面においてアイポイントより画面の端へ入射する法線の入射角、θ_2 は、画面の端の点をＲ，Ｒより光軸へ下した垂線と光軸との交点をＨ′，Ｈ′とＲとの間の距離をｈｒ，交点Ｈ′よりアイポイントまでの範囲で交点Ｈ′より距離ｍだけ離れた点での光軸を挟んで点Ｒがある側とは反対の側の装置枠までの高さをｈｍとしたとき、$\tan^{-1}(hr + hm) / m$ で表わされる値の最小値である。

【発明の詳細な説明】

【０００１】

【産業上の利用分野】本発明は、液晶表示装置等によって形成された像を光学系を介して観察できるようにしたカムコーダー用ファインダーやスチルビデオファインダーの如き画像観察装置に関する。

【０００２】

【従来の技術】この種の画像観察装置においては、外部から装置内部へ光が入ると、その反射光のために像が見難くなる。そのため、従来、フード部分を改良して外光が装置内部へ入射しないようにするか、又は装置内部の反射面に反射防止膜等を施して反射率を減らす等の対策がとられていた。

【発明が解決しようとする課題】

【０００３】電子映像分野のカメラにおいては、従来からＣＲＴやＬＣＤ等の画面を光学系で拡大して見る方式のファインダーが用いられて来た。然し、ＣＲＴに比べて画面の暗いＬＣＤにおいては、上記のような反射率を減らす等の対策を講じたとしても、尚ファインダーレンズ面やＬＣＤ表面による外光の反射が無視できず問題となっている。

【０００４】又、実開平１－１４６２２７号において提案された如き遮光板とフードを用いる方式の場合には、ファインダー内への外光の進入を効率良く防止するためには遮光板をより大きくしなければならないが、これはファインダー装置の取り扱いや持ち運びを不便にするばかりか、観察時に観察者の皮膚に直接触れる部分が多くなり、観察者に不快感を与えると云う問題点がある。

又、反射防止膜を用いるとコストアップになると云う問題もある。

【０００５】本発明は、従来の技術の有するこのような問題点に鑑みてなされたものであり、その目的とするところは、内部に進入した外光の反射をより低減させて画像の見えを向上させることのできる画像観察装置を提供することにある。

【課題を解決するための手段】

【０００６】上記目的を達成するために、本発明による画像観察装置は、液晶セルの如き画像表示装置と、画像表示装置と観察者の眼との間に配置された少なくとも一つの光学系と、該光学系と眼との間に配置された偏光素子とを備えている。

【０００７】偏光素子は液晶セルと光学系を挟むような配置で二枚用いられてもよいし、液晶セルと光学系の間に更に一枚の偏光素子を介在させた配置で三枚用いられ

てもよい。この場合、眼側から一枚目と二枚目の偏光素子は偏光方向が実質上平行になるように配置されている。又、光学系は単一のガラスレンズであり、偏光素子と表示装置との間には（２ｎ＋１）λ／４（但し、ｎ＝０，１，２，３，‥‥、λ＝光の波長）の位相差を生じさせる波長板が配置されていてもよい。更に、二枚の波長板は軸方向が平行又は直交していて偏光板に対し４５°の角度をなすように配置される。

【０００８】更に、偏光素子は表示装置よりも眼側で表面に立てた法線が光軸に対して（$\theta_1+\theta_2$）／２＜θ＜８５°なる条件を満足する角度θをなして傾斜するように配置され得る。但し、θ_1は斜向配置された偏光板の上記法線と光軸とを含む平面においてアイポイントより画面の端へ入射する光線の入射角、θ_2は、画面の端へ入射する前記光線と偏光板との交点をＰ，交点Ｐから光軸へ下した垂線と光軸との交点をＨ，交点ＰとＨとの間の距離をｈｐ，交点Ｈよりアイポイントまでの範囲で交点Ｈより距離ｌだけ離れた点での光軸を挟んで交点Ｐがある側とは反対の側の装置枠までの高さをｈｌとしたとき、$\tan^{-1}(hp+hl)/l$で表わされる値の最小値とする。又、この場合、偏光板はその透過軸が上記法線と光軸とを含む面内にあるよう配置される。

【０００９】画像表示装置は、その表面の法線と光軸との角θが（$\theta_1+\theta_2$）／２＜θなる条件を満足するよう傾斜して配置され得る。但し、θ_1は斜向配置された表示装置の上記法線と光軸とを含む平面においてアイポイントより画面の端へ入射する光線の入射角、θ_2は、画面の端へ入射する前記光線の画面との交点をＲ，交点Ｒから光軸へ下した垂線と光軸との交点をＨ′，交点ＲとＨ′との間の距離をｈｒ，交点Ｈ′よりアイポイントまでの範囲で交点Ｈ′より距離ｍだけ離れた点での光軸を挟んで交点Ｒがある側とは反対の側の装置枠までの高さをｈｍとしたとき、$\tan^{-1}(hr+hm)/m$で表わされる値の最小値とする。

【００１０】

【作用】カムコーダー用ファインダーやスチルビデオファインダーのような電子ファインダー（以下、ＥＶＦと云う）において、見えにくさの一因となる外光の反射は、主にレンズ表面と表示装置の表面からのものである。本発明によれば、ＥＶＦにおいて偏光素子が液晶表示装置（以下、ＬＣＤと云う）よりも眼に近い側に配置されているから、観察すべき画像を形成する光を減衰させずに外光とその反射光を減衰させることができ、見えを向上させるものである。

【００１１】即ち、図１に示すように、光学系としてのレンズ５と眼との間に、ＬＣＤを構成する液晶パネル３の眼側の偏光板４と同じ向きに偏光軸の揃えられた偏光フィルター６を配置して、従来のＥＶＦにおいて眼側から入射した外光がＥＶＦ内部で反射して眼に入って来る光の強度をＲ，ＬＣＤから出て眼に入って来る光の強度をＳ，偏光フィルター６の透過率をＴ，偏光フィルター６の平行透過率（偏光軸と平行な偏光の透過率）をT_pとすると、外光はＥＶＦへの入射時と内部で反射して外部へ射出する時の２回偏光フィルター６を透過することになるので、その強度ＮはＴ×T_p×Ｒとなる。一方、ＬＣＤから出た光は既に偏光となっているので偏光フィルター６を透過した後の強度ＳはT_p×Ｉとなる。ここで、Ｓ／Ｎ比をとると、（T_p×Ｉ）／（Ｔ×T_p×Ｒ）＝（１／Ｔ）（Ｉ／Ｒ）となり、Ｔ＜１であるのでＳ／Ｎ比は向上する。

【００１２】又、上記構成において、液晶パネル３の眼側にはレンズ５を挟んで偏光軸を同じ向きに揃えた偏光素子が二枚あるが、像を見るためにはこの内の一枚があればよいので、図２に示すようにＬＣＤを構成する眼側の偏光板４は取り除いてもよい。取り除いた偏光板４の作用は偏光フィルター６により代行することができ、この場合像の光の強さは図１の場合と同じくＩとなる。ここでＳ／Ｎ比をとると、Ｉ／（Ｔ×T_p×Ｒ）＝〔１／（Ｔ×T_p）〕・（Ｉ／Ｒ）となり、T_p＜１であるので、Ｓ／Ｎ比はより向上する。

【００１３】上記のようにＥＶＦの最も眼に近い側に偏光素子を配置することにより、ＥＶＦへの入射光と反射光を減衰させ、像のＳ／Ｎ比を向上させて、見えを良くすることができる。

【００１４】又、図９に示すように、ＬＣＤを、バックライト１側から眼側へ向けて順次配列された偏光板２，（２ｎ＋１）λ／４波長板１２（ｎ＝０，１，２，３，‥‥、λ＝光の波長），液晶セル３，（２ｍ＋１）λ／２波長板１３（ｍ＝０，１，２，３，‥‥）及び偏光板４で構成すれば、眼側から入射して偏光板４を透過した光のうち、像を観察する上で有害となる液晶セル３の後面より眼側にある面からの反射光は、波長板１３を２回通ることになり、偏光面の向きが９０°回転するので、偏光板４で殆ど吸収される。これにより、液晶セル３内部での反射も減少させることができる。一方、バックライト１側の光は、偏光板２を通ることにより直線偏光となり、波長板１２を通過することにより円偏光となるが、波長板１３を通過することにより再び直線偏光となり、偏光板４に入射するので従来と同様に画像を得ることができる。

【００１５】又、図１０に示すように、偏光板６の表面に立てた法線と光軸とのなす角θが条件式（$\theta_1+\theta_2$）／２＜θ＜８５を満たす時、アイポイントＥＰから出てファインダー内に入射し偏光板６の表面で反射した光は、枠に当り外に出ることはない。逆に考えると、外から入射した光が偏光板６の表面で反射しても、その光が眼に入ることはない。但し、θ_1は斜向配置された偏光板の上記法線と光軸とを含む平面においてアイポイントより画面の端へ入射する光線の入射角、θ_2は、画面の端へ入射する前記光線と偏光板との交点をＰ，交点

Ｐから光軸へ下した垂線と光軸との交点をＨ，交点ＰとＨとの間の距離をｈｐ，交点Ｈよりアイポイントまでの範囲で交点Ｈより距離ｌだけ離れた点での光軸を挟んで交点Ｐがある側とは反対の側の装置枠までの高さをｈｌとしたとき，$\tan^{-1}(hp+hl)/l$で表わされる値の最小値とする。更に、表面での反射率は入射角度に依存し、光の振動方向により異なる値をとる。反射面に平行なＳ成分は、入射角が増加するに従い単調に増加し、一方、反射面の法線と入射光線を含む面に含まれるＰ成分は、入射角が増えるに従い一時減少し、入射角が$\tan^{-1}n$（ｎは偏光板６の屈折率）と等しくなる時０となる。その後は単調に増加するが、入射角が０°から９０°の範囲でＳ成分≧Ｐ成分となる。又、偏光板６の透過軸をＰ成分となる方向に揃えることにより、傾けた偏光板６のＰ成分の透過率は、$\theta=\tan^{-1}n$付近で最大となり、コーティングを施さなくても充分な透過率を得ることが出来る。同時に、Ｓ成分を含んでいる外光の透過率は、θが増えるにつれて減少するので、偏光板６よりＬＣＤ側にある反射面による反射は減少する。

【００１６】又、図１１に示すように、画像表示装置（ＬＣＤ）の表面に立てた法線と光軸とのなす角をθとし、$\theta>(\theta_1+\theta_2)/2$なる条件を満足する時、ア

単体透過率（Ｔ）４３％
直交透過率（T_C）４．２％

【００１８】外光は、眼の側から装置枠Ｆの内部に入射し、偏光フィルター６を透過し、内部で反射し再び偏光フィルター６を透過して眼に入る。従って、反射光は２回偏光フィルター６を通ることになり、光の強さは３３．５％に減少する。一方、ＬＣＤからの光も偏光フィルター６を通って眼に入るため、その光の強さは従来（無対策時）とは異なり８１．８％に減少する。従って、無対策時のＳ／Ｎ比を１と置くと本実施例の場合のＳ／Ｎ比は２．４４となり、Ｓ／Ｎ比が著しく向上することが分かる。尚、偏光フィルター６の表面反射を防ぐため、偏光フィルター６の表面には反射防止膜を施した。本実施例は、従来のＬＣＤを用いたＥＶＦに偏光フィルターを付加するだけで済むから、極めて容易且つ安価に実施することができる。

【００１９】図２は本発明の第２実施例を示している。この実施例は、ＬＣＤから偏光板４が除去されている点で第１実施例とは異なる。従って、偏光板２と液晶セル３の表面反射率が同じであるとすると、眼に入る外光による反射光の強さは第１実施例の場合と同様に３３．５％に減少する。一方、ＬＣＤからの光は、無対策時の構成でＬＣＤの眼側の偏光板がレンズの前側に移動したものと同様に考えられるので、強度の変化は無いと考えると、Ｓ／Ｎ比は２．９９となり、第１実施例よりもＳ／Ｎ比が更に向上する。

【００２０】第２実施例では、像の明るさを減少させることなく外光による反射光のみを低減することができるイポイントから出てファインダーに入射し画像表示装置の表面及び内部で反射した光は、枠にあたり外に出ることはない。逆に考えると、外から入射した光が画像表示装置の表面及び内部で反射しても、その光が眼に入ることはない。但し、θ_1は斜行配置された表示装置の上記法線と光軸を含む平面において、アイポイントより画面の端へ入射する光線の入射角、θ_2は、画面の端の点をＲ，Ｒより光軸へ下した垂線と光軸との交点をＨ′，Ｈ′とＲとの間の距離をｈｒ，交点Ｈ′よりアイポイントまでの範囲で交点Ｈ′より距離ｍだけ離れた点での光軸を挟んで点Ｒがある側とは反対の側の装置枠までの高さをｈｍとした時、$\tan^{-1}(hr+hm)/m$で表わされる値の最小値とする。

【００１７】

【実施例】図１は本発明の第１実施例を示している。図中、Ｆは装置枠、１はバックライト、２は偏光板、３は液晶セル、４は偏光板、５はガラスレンズ、６は偏光フィルターである。この場合、偏光板２，４及び偏光フィルター６の各偏光面は同じ方向に揃えられており、偏光フィルター６としては下記の特性を有するものが使用された。尚、偏光板２，４と液晶セル３はＬＣＤを構成している。

平行透過率（T_P）８１．８％
偏　光　度　　９５％

ばかりか、ＬＣＤ部の部品点数を減らすこともできるので、その効果は大である。本実施例では、光学系の複屈折による影響を防ぐため、ガラス又はアクリル等の複屈折の生じ難い材料で光学部品を構成すると良い。又、外光が観察者の顔面で１度反射した後ＥＶＦ内へ入射する場合は部分偏光となっているので、その偏光方向と直交する方向に偏光フィルター及び偏光板を配置することにより、一層効率良く眼に入る外光を減少させることができる。

【００２１】図３は本発明の第３実施例を示している。この実施例は、偏光フィルター６をその表面に立てた法線が光軸に対しθ°（ほぼ４５°程度）をなすように傾けて配置して外光がその表面で反射しても眼に入らないようにした点で、第２実施例とは異なる。このように偏光素子を傾けることにより、眼側から入射した外光のうち偏光素子の表面で反射した光は装置枠Ｆの壁に当り吸収されるため、偏光素子を付加した場合でもそれによる反射面の増加の影響を減らすことができる。偏光フィルター６より後側（バックライト１側）の面については第２実施例と同様の効果がある。尚、上記θは、図１０に示すように、斜向配置された偏光フィルター６の表面に立てた法線と光軸とを含む平面においてアイポイントＥＰよりＬＣＤの画面の端Ａへ入射する光線の入射角をθ_1、この光線と偏光フィルター６との交点をＰ，この交点Ｐから光軸へ下した垂線と光軸との交点をＨ，交点ＰとＨとの間の距離をｈｐ，交点ＨよりアイポイントＥＰ

までの範囲で交点Ｈより距離１だけ離れた点での光軸を挟んで交点Ｐがある側とは反対の側の装置枠Ｆまでの高さをｈｌとしてtan⁻¹（ｈｐ＋ｈｌ）／ｌで表わされる値の最小値をθ_2としたとき、（$\theta_1+\theta_2$）／２＜θ＜８５°なる条件を満足するように選定される。

【００２２】ＥＶＦにおいて、より高倍率での観察を可能とするため、回折格子等の光学部材を用いることがある。これを用いた実施例が、第４，５及び６実施例として以下に説明される。

【００２３】図４は本発明の第４実施例を示している。この実施例は、ＬＣＤにおいて偏光板４の代わりにドットレイサフィルター（点像（ドット）で構成されている画像のドット間隔に対応する周波数成分をカットするフィルター）７が液晶セル３に接合されている点で第１実施例とは異なる。この場合も、第２実施例と同様に偏光フィルター６が眼に最も近い側に在り、光学部材の各面の反射の影響は約１／３となる。

【００２４】図５は本発明の第５実施例を示している。この実施例は、偏光フィルター６をその表面に立てた法線が光軸に対しθ°（ほぼ４５°程度）をなすように傾けて配置して外光がその表面で反射しても眼に入らないようにした点で第４実施例とは異なる。この場合の利点は第３実施例の場合と同様であり、θの選定条件も第３実施例の場合と同じである。

【００２５】図６は本発明の第６実施例を示している。この実施例は、ドットレイサフィルター７を液晶セル３から離して偏光フィルター６と接合しこれをＬＣＤとレンズ５との間に配置した点で、第５実施例とは異なる。この場合は、接合により光学部材の空気接触面を減らすことができ、液晶セル３の眼側表面の反射の影響を１／３にすることができる。

【００２６】図７は本発明の第７実施例を示している。この実施例は、レンズ５と偏光フィルター６の代わりに凸平レンズ８と偏光膜９と平凸レンズ１０を順に接合して用いた点で、第２実施例とは異なる。この場合は、レンズ８及び液晶セル３の各面の反射の影響を１／３にすることができ、又接合を用いていることにより空気接触面を減らすことができる。尚、偏光膜９は非常に薄く、接合したレンズは前記各実施例におけるレンズ５と等価になるように成形されている。

【００２７】図８は本発明の第８実施例を示している。この実施例は、レンズ１１の一方の面を平面にしてその平面に偏光フィルター６が接合されている点で、第７実施例とは異なる。この場合は、第７実施例と同様にレンズ，光学部材の反射の影響を１／３にすることができる。

【００２８】更に、ＬＣＤの液晶セルの内部の電極等による反射も考慮した実施例を第９実施例として以下に説明する。図９は本発明の第９実施例を示している。この実施例は、ＬＣＤにおいて液晶セル３と偏光板２及び４との間に１／４波長板１２及び１３が夫々介在せしめられていて、偏光フィルター６が用いられていない点で前記何れの実施例とも異なる。この場合、偏光板４を透過して１／４波長板１３と１２の間で反射した光は、振動面が９０°回転するので、偏光板４を殆ど透過することはできない。従って、液晶セル３内部の電極等による光の反射による影響もほぼ無くすことができる。偏光板の偏光軸の方向と１／４波長板の軸方向とは４５°ずらされている。又、波長板としては、（２ｎ＋１）λ／４（ｎ＝０，１，２，３，‥‥）の波長板を用いることができるが、波長特性を減らすためにλ／４波長板が好ましい。

【００２９】図１２は本発明の第１０実施例を示している。この実施例は、ＬＣＤをその表面に立てた法線が光軸に対しθ°（２０°程度）をなすように傾けて配置して、外光がその表面で反射しても眼に入らないようにした点で前記何れの実施例とも異なる。本実施例によれば、部材を増やすことなくＬＣＤ表面及び内部からの反射光を眼に入らないようにすることが出来る。この場合、像面の傾きによる視度ずれの影響を少なくするために、θの値は小さい方が望ましい。

【００３０】以上各実施例において用いたレンズの数値データを示せば下記の通りである。

レンズ５

f_B＝41.00

R_1＝32.72　　D_1＝4.8　　n＝1.56384　　ν＝60.69

R_2＝-87.40（非球面）

E＝0.115 ×10⁻⁴　　F＝-0.2457 ×１０⁻⁷

G＝-0.7378 ×10⁻¹⁰　　H＝0.3220×１０⁻¹²

レンズ８

f_B＝41.00

R_1＝32.72　　D_1＝3.0　　n＝1.56384　　ν＝60.69

R_2＝∞

レンズ１０

R_1＝∞　　D_1＝1.8　　n＝1.56384　　ν＝60.69

R_2＝-87.40（非球面）

E＝0.115 ×10⁻⁴　　F＝-0.2457 ×１０⁻⁷

G＝-0.7378 ×10⁻¹⁰　　H＝0.3220×１０⁻¹²

レンズ１１

f_B＝43.00

R_1＝23.956（非球面）　D_1＝5.0　　n＝1.56384　　ν＝60.69

E＝0.1298×10⁻⁴　　F＝-0.1049 ×１０⁻⁸

G＝0.8035×10⁻¹¹

R_2＝∞

但し、f_BはレンズのＬＣＤ側の面頂位置から液晶セル（像面）までの距離（Ｆバック）、R_1，R_2は曲率半

径、D_1は厚さ、ｎは屈折率、νはアッベ数、Ｅ，Ｆ，Ｇ，Ｈは非球面係数である。

【００３１】上記各実施例では１枚のレンズを用いたが、これに代えてレンズ系を用いてもよく、又レンズ（レンズ系）を前後に動かして視度補整機構を付加してもよいし、更にファインダー系にミラーを挿入して光路を曲げ装置全体をコンパクトに構成できるようにしてもよい。

【００３２】

【発明の効果】上述の如く本発明によれば、偏光によって構成されている像に比べて、偏光板より後側で生じる外光による反射光を大幅に減少させることができ、像のＳ／Ｎ比を向上させ、極めて見易い画像観察装置を安価に提供することができる。

【図面の簡単な説明】

【図１】本発明の第１実施例を示す側面図である。

【図２】本発明の第２実施例を示す側面図である。

【図３】本発明の第３実施例を示す側面図である。

【図４】本発明の第４実施例を示す側面図である。

【図５】本発明の第５実施例を示す側面図である。

【図６】本発明の第６実施例を示す側面図である。

【図７】本発明の第７実施例を示す側面図である。

【図８】本発明の第８実施例を示す側面図である。

【図９】本発明の第９実施例を示す側面図である。

【図１０】本発明の第３実施例と第５実施例における偏光フィルターの傾斜条件を説明するための図である。

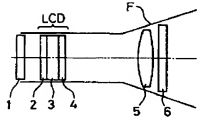
【図１１】画像表示装置の傾斜条件を説明するための図である。

【図１２】本発明の第１０実施例を示す側面図である。

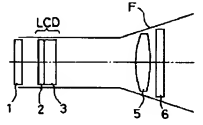
【符号の説明】

1	バックライト
2，4	偏光板
3	液晶セル
5，8，１０，１１	レンズ
6	偏光フィルター
7	ドットレイサフィルター
9	偏光膜
F	装置枠

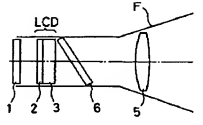
【図１】



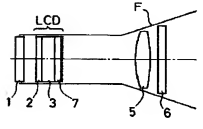
【図２】



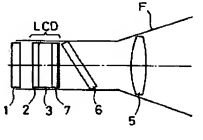
【図３】



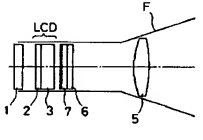
【図４】



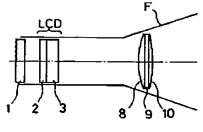
【図５】



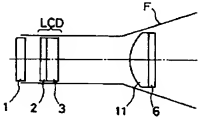
【図６】



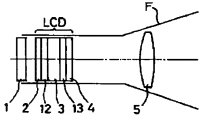
【図７】



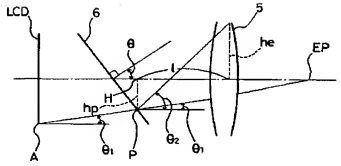
【図８】



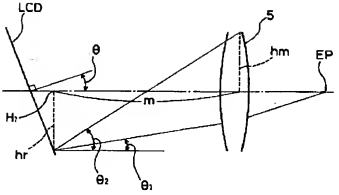
【図９】



【図１０】



【図１１】



【図１２】